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APPLICANT : FUJISATO RYOSAKU;

INVENTOR : FUJISATO RYOSAKU;

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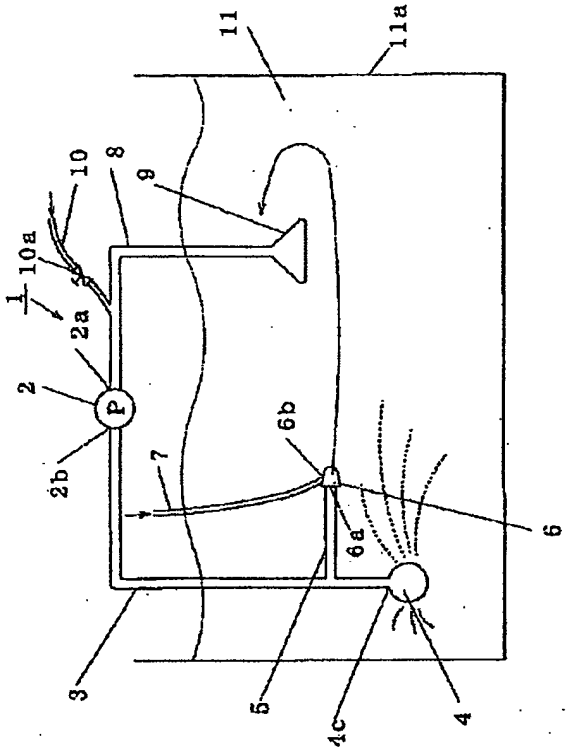
TITLE : WATER-JET TYPE FINE BUBBLE GENERATOR



ABSTRACT : PROBLEM TO BE SOLVED: To provide a water-jet type fine bubble generator which generates a large quantity of fine bubbles in a wide range together with a water current in water of a water tank, a pool, an aeration tank, a river, or the like, in water (seawater) of a culture pond, a nursery on the coast, or a fresh fish carrier, or in liquid of a gas-liquid reaction tank in a chemical factory.

SOLUTION: This generator is provided with a fine bubble generator, an introducing pipe which has the lower side connected to an introducing hole, and a water current pipe which is connected to a prescribed part of the introducing pipe and has the lower side opened. The fine bubble generator has a generator body having a hollow part converging from the rear side toward the front end part on the inside, the introducing hole which is arranged on the rear side of the generator body in the tangential direction, and a gasliquid spray nozzle arranged in the front end part of the generator body.

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PN - JP2002059186 A 20020226
TI - WATER-JET TYPE FINE BUBBLE GENERATOR
AB - PROBLEM TO BE SOLVED: To provide a water-jet type fine bubble generator which generates a large quantity of fine bubbles in a wide range together with a water current in water of a water tank, a pool, an aeration tank, a river, or the like, in water (seawater) of a culture pond, a nursery on the coast, or a fresh fish carrier, or in liquid of a gas-liquid reaction tank in a chemical factory. SOLUTION: This generator is provided with a fine bubble generator, an introducing pipe which has the lower side connected to an introducing hole, and a water current pipe which is connected to a prescribed part of the introducing pipe and has the lower side opened. The fine bubble generator has a generator body having a hollow part converging from the rear side toward the front end part on the inside, the introducing hole which is arranged on the rear side of the generator body in the tangential direction, and a gasliquid spray nozzle arranged in the front end part of the generator body.
FI - B01F3/04&C; B01F5/00&G; C02F3/20&Z
PA - FUJISATO RYOSAKU
IN - FUJISATO RYOSAKU
AP - JP20000247822 20000817
PR - JP20000247822 20000817
DT - I

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AN - 2002-398794 [43]
TI - Water flow type gas bubble generator for water purification in pool, has water flow pipe with opened downstream end connected to specific portion of inlet tube
AB - NOVELTY :
Vessel with a hollow portion has a transduction hole arranged in direction of tangent and a gas-liquid mixture injection hole provided to front end portion. The downstream side of an inlet tube (3) is connected to the transduction hole. A water flow pipe (5) with opened downstream end, is connected to specific portion of inlet tube.
- USE :
Water flow type gas bubble generator for water purification in water tank, pool, aerator, river, pond, coast, fresh fish carrier vehicle or chemical plant.
- ADVANTAGE :
The gas bubbles are diffused broadly and the size of bubbles are adjusted easily, so excellent maintenance property and productivity are obtained.
- DESCRIPTION OF DRAWINGS :
The figure shows the water flow type gas bubble generator installed in fish preservator.
3 : Inlet tube
5 : Water flow pipe
IW - WATER FLOW TYPE GAS BUBBLE GENERATOR PURIFICATION POOL PIPE OPEN DOWNSTREAM END CONNECT SPECIFIC PORTION INLET TUBE
PN - JP2002059186 A 20020226 DW200243
IC - C02F3/20; B01F3/04; B01F5/00
ICAI - B01F3/04; B01F5/00; C02F3/20
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(71)出願人　300040818
藤里　良策
山口県宇部市野中４丁目10－25
(72)発明者　藤里　良策
山口県宇部市野中４丁目10－25
(74)代理人　100095603
弁理士　板本　一郎

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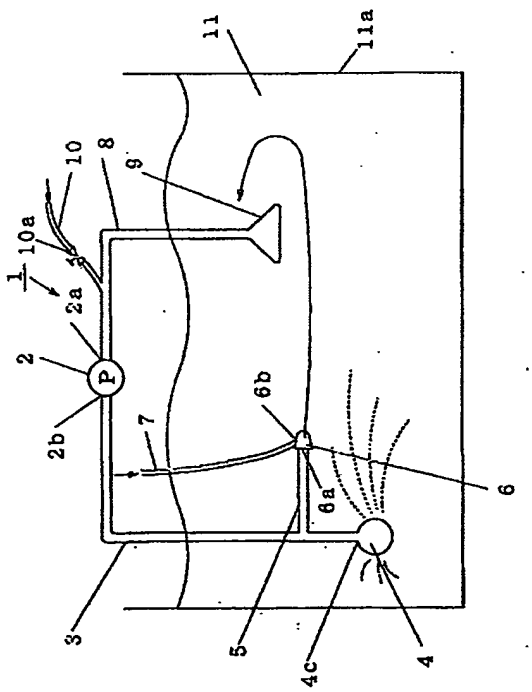
4G035 AB15 AB16 AB30 AC44 AE13

(54)【発明の名称】　水流式微細気泡発生装置

(57)【要約】
【課題】　本発明は、水槽やプール、曝気槽、河川等の水中又は養殖池や沿岸の養殖場もしくは鮮魚運搬車の水（海水）中、又は化学工場における気液反応槽の液中に微細な気泡を水流とともに多量かつ広範囲に発生させることができる水流式微細気泡発生装置を提供することを目的とする。
【解決手段】　ａ．後部側から前端部に向かって集束する形状の中空部を内部に有する器体と、器体の後部側に接線方向に配設された導入孔と、器体の前端部に配設された気液噴出孔と、を有している微細気泡発生器と、ｂ．下流側が導入孔に接続された導入管と、ｃ．導入管の所定部に接続され下流側が開口された水流管と、を備えている構成を有する。



方、微細気泡発生器内の気液混合流体は、旋回しながら気液噴出孔に近づくにつれて、旋回速度が速くなるとともに圧力が高くなり、気液噴出孔付近で旋回速度及び圧力は最大となり、負圧液と押し合う状態になる。負圧軸に集まった気体は、負圧液と旋回している気液混合流体とによって形成された間隙を圧縮気体となって剪断されながら通過し、気液混合流体とともに多量の微細気泡として気液噴出孔から液相へ噴出される。

（2）旋回しながら噴出される気液混合流体と負圧液とにより、負圧軸に集まった気体は圧縮・剪断され、引きちぎられるようにして噴出されるので、多量のナノメータ乃至マイクロメータオーダーの微細気泡を発生させることができる。

（3）導入管から水流管へ流入した気液混合流体は液相へ流れ込み、水流を形成する。この水流にのって、微細気泡が広範囲に拡散される。

（4）微細気泡発生用のポンプと水流発生用のポンプを別々に備える必要がなく、1機のポンプで微細気泡及び水流を発生させることができるので、生産性に優れるとともにメンテナンス性に優れる。

（5）微細気泡を多量に発生させるので、気体と液体の接触面積を大きくすることができ、気液反応装置における反応や、浄化装置における浄化を促進させることができる。また、養殖池や養殖場もしくは活魚運搬車の水（海水）中の溶存酸素量を増加させることができる。

【0008】ここで、器体としては、円錐形状、円錐台形状、半球形状、砲弾形状のもの等が用いられる。円錐形状、円錐台形状の器体を用いた場合、器体が導入孔から気液噴出孔に向かって一気に収束する形状を有しているので、器体内を旋回する流体に急激な剪断力が働き、粘度が高い流体でも充分に撹拌させることができる。また、気液噴出孔の形状は三角や四角等の多角形や円形、楕円形のものが用いられる。円形にした場合、均質な微細気泡を得ることができる。気液噴出孔から噴出される気泡の粒径や水流管から吐出される流体の流速は、導入管や水流管の管径の比や器体の形状に基づく旋回速度により適宜選択される。水流管の形状としては、単なる管状、内径が下流側に向かって徐々に小さくなる形状等が用いられる。また、水流管は下流側の端部を微細気泡を拡散させたい方向に向けて配設される。導入管と水流管の気液混合流体の分流比は導入管に導入される流体の圧力や流速によって異なるが、水流管側への分流比は5～80%の範囲で分流される。分流比が5%未満になるにつれ分流管の流速が弱く微細気泡の拡散範囲が狭く、また、80%を越えるにつれ微細気泡の発生量が少なくなる傾向が認められるので、好ましくない。導入孔と気液噴出孔の口径比は導入管の導入流体の圧力や流速によって適宜選択されるが、微細気泡の発生量や拡散範囲を大きくとる場合は、導入孔の口径は気液噴出孔の口径より大きくされる。

【0009】本発明の請求項2に記載の発明は請求項1に記載の水流式微細気泡発生装置であって、前記微細気泡発生器が、中間部から両端部に向かって集束する形状の中空部を内部に有する器体と、前記器体の前記中間部に接線方向に配設され前記器体内で開口する導入孔を有する導入管と、前記器体の前記導入管を中心として略対称位置に穿設された気液噴出孔と、を備えている構成を有している。

【0010】この構成により、請求項1の作用に加え、以下のような作用が得られる。

（1）器体の導入管を中心として略対称の位置に気液噴出孔が穿設されているので、器体の両側から多量の微細気泡をより広範囲に拡散させることができる。

（2）気液噴出孔を2個所備えているので、微細気泡の粒径の調整を容易に行うことができる。

（3）微細気泡の発生率を著しく高めることができる。ここで、器体としては、円錐又は円錐台の底面どうしを連通させた形状、球形状、卵形状のもの等が用いられる。円錐又は円錐台の底面どうしを連通させた形状の器体を用いた場合、器体が導入孔から気液噴出孔に向かって一気に収束する形状を有しているので、器体内を旋回する流体に急激な剪断力が働き、粘度が高い流体でも充分に撹拌させることができる。また、気液噴出孔から噴出される気泡の量や水流管から吐出される流体の流速は、導入管や水流管の管径の比や器体の形状に基づく旋回速度により適宜選択される。

【0011】本発明の請求項3に記載の発明は請求項1に記載の水流式微細気泡発生装置であって、前記微細気泡発生器の後端部又は後部壁に穿設された気体自吸孔と、一端側が前記気体自吸孔に接続され他端側が開口された気体自吸管と、を備えている構成を有している。

【0012】この構成により、請求項1の作用に加え、以下のような作用が得られる。

（1）導入管から器体内に気液混合流体でなく液体のみを流入させても、接線方向から器体内に流入した液体には遠心力が働き、中心部は負圧となりその分中心部には気体自吸管から気体が流入し負圧軸が形成される。

（2）気体自吸管を大気に開放したり、目的とする吸収又は反応ガス（例えば、CO_2，HCl，HCN，SO_2，$COCl_2$，フッ素化合物ガス等他の反応ガス）に接続するだけで液体に気体を吸収もしくは反応させることができる。

【0013】ここで、ポンプへの気体の吸込量は、ポンプのキャビテーションを起こす範囲外で行われる。更に、気体の吸込みは液体の粘度の低い方に行う方が気体の高拡散化が図られるので好ましい。また、水流式微細気泡発生装置は、浄水場や河川の浄化、畜産排尿の浄化、活魚の輸送時や養殖時等の酸素供給、水耕栽培時の溶存酸素量増加、ヘドロ等の浮上による汚濁水処理、貯水槽のカルキ類の除去、オゾン混合による殺菌，滅菌，

ける水流式微細気泡発生装置、２は吸込口２ａ及び吐出口２ｂを有するポンプ、３は上流側がポンプ２の吐出口２ｂに接続された導入管、４は導入管３の下流側に接続された微細気泡発生器、５は上流側が導入管３の所定部で分岐して接続された水流管、６は水流用気体自吸孔６ａに水流管５の下流側が接続された水流発生ノズル、７は一端が水流発生ノズル６の水流用気体自吸孔６ｂに接続され他端側が大気中で開口された水流用気体自吸管、８は下流側がポンプ２の吸込口２ａに接続された吸込管、９は吸込管８の上流側に配設されたストレーナ、１０は一端側が吸込管８の所定部に分岐して接続され他端側が大気中で開口された気体自吸管、１０ａは気体自吸管１０の所定部に配設された気体流量調整器、１１は微細気泡発生装置１が配設された水槽や生簀１１ａ等の液相である。

【００２４】図２（ａ）は本発明の実施の形態１における微細気泡発生器の要部斜視図であり、図２（ｂ）はその正面図であり、図２（ｃ）はその要部側面図である。図２において、３は導入管、４は微細気泡発生器、４ａは中間部から両端部に向かって内部が集束する形状（略中空球状）の中空部を有する器体、４ｂは器体４ａに接線方向に開口された導入管３の導入孔、４ｃは器体４ａの導入孔４ｂから中心部に向けた直線と中心部で直交する直径方向の両端部に穿設された気液噴出孔である。

【００２５】図３は本発明の実施の形態１における水流発生ノズルの一例を示す側面断面図である。図３において、５は水流管、６は水流発生ノズル、７は水流用気体自吸管であり、これらは図１と同様のものなので同一の符号を付してその説明を省略する。６ａは後部から流入した流体を加速させ前部側から吐出する水流用器体、６ｂは水流用器体６ａの後端部に配設固定され前部側に向かって開口面積が徐々に絞られた形状を有する水流用吸込管である。水流用吸込管６ｂには水流管５の下流側端部が接続されている。６ｃは水流用器体６ａの側壁に穿設された水流用気体自吸孔、６ｄは水流用器体６ａの前端部に水流用吸込管６ｂと略同軸に穿設された水流用噴出孔である。水流管５から水流発生ノズル６に流入する流体は、水流用吸込管６ｂを加速しながら通過し水流用器体６ａに流入し、水流用噴出孔６ｄから噴出される。この流体の随伴流として、水流用気体自吸管７から水流用気体自吸孔６ｃを経て、水流用器体６ａに空気が流入し、水流用吸込管６ｂからの流体とともに水流用噴出孔６ｄから噴出される。

【００２６】以上のように構成された本発明の実施の形態１における水流式微細気泡発生装置について、以下図面を参照しながらその動作を説明する。図４は本発明の実施の形態１における微細気泡発生器内部の流体の状態を示す要部正面状態図である。図４において、３は導入管、４は微細気泡発生器、４ａは器体、４ｂは導入孔、４ｃは気液噴出孔であり、これらは図２と同様のものであるので同一の符号を付してその説明を省略する。Ｘは微細気泡発生器４内を旋回する気液混合流体の気体と液体との比重差により形成される負圧軸である。図１において、ポンプ２を駆動させると、液相１１の液体は、ストレーナ９を経て吸込管８に流入する。吸込管８の気体自吸管１０との接続部において、吸込管８内に気体自吸管１０から空気が液体の随伴流として吸引され、気液混合流体となり、ポンプ２の吸込口２ａからポンプ２内に吸い込まれる。ポンプ２内に吸い込まれた気液混合流体は、ポンプ２のインペラ（図示せず）により、気泡が拡散されながらポンプ２の吐出口２ｂから導入管３内に吐き出される。導入管３に流入した気液混合流体は、微細気泡発生器４と水流管５に分岐して流出する。

【００２７】図４において、導入管３から導入孔４ｂを経て接線方向から微細気泡発生器４内に流入した高圧の気液混合流体は、器体４ａの内壁面に沿って旋回することにより激しく気液混合されながら、気液噴出孔４ｃ側へ移動していく。この際、液体と気体との比重の差によって、液体には遠心力が働き、空気には向心力が働き、減圧された空気相からなる負圧軸Ｘが形成される。また、負圧軸Ｘにより、気液噴出孔４ｃ付近の液相１１の液体には、微細気泡発生器４内に進入しようとする力が働く（以下、この力が働く液体を負圧液という）。一方、微細気泡発生器４内の気液混合流体は、旋回しながら気液噴出孔４ｃに近づくにつれて、旋回速度が速くなり、気液噴出孔４ｃ付近で旋回速度は最大となり、負圧液と押し合う状態になる。よって、負圧軸Ｘに集まった気体は、負圧液と旋回している気液混合流体との間を圧縮・剪断されながら通過し、微細気泡発生器４の球面に沿うようにして多量のナノメータ乃至マイクロメータオーダーの微細気泡として気液噴出孔４ｃから液相１１へ噴出される。

【００２８】一方、図３において、水流管５に流入した気液混合流体は、水流発生ノズル６により加速され液相１１内に噴出される。これにより、液相１１内に水流が発生し、微細気泡発生器４の気液噴出孔４ｃから噴出された微細気泡がこの水流に遠方まで運ばれ広範囲に拡散される。

【００２９】尚、本実施の形態１においては、２口の気液噴出孔４ｃを有した球形状の微細気泡発生器４を用いたが、気液噴出孔が１口で半球形状、砲弾形状、円錐台形状、円錐形状の微細気泡発生器を用いても同様に実施可能である。また、本実施の形態１においては、水流用気体自吸孔６ｃを有する水流発生ノズル６を用い、水流発生ノズル６内に気体を流入させる構成にしたが、単に後部側から前部側に向かって徐々に内径が小さくなる形状の管を接続しても水流管５からの流体を加速させることができるので同様に実施可能である。また、水流発生ノズル６を用いず、直接水流管５から液相１１内に流体を流入させる場合もあるが、この場合でも水流管５に下

微細気泡発生器２２内を旋回する気液混合流体の気体と液体との比重差により形成される負圧軸である。図５において、ポンプ２を駆動させると、液相１１の液体は、ストレーナ９、吸込管８、ポンプ２を経て導入管３に流入する。導入管３に流入した気液混合流体は、微細気泡発生器２２と水流管５に分岐して流入する。図７において、導入管２１から導入孔２２ｂを経て接線方向から微細気泡発生器２２内に流入した高圧の気液混合流体は、器体２２ａの内壁面に沿って旋回しながら、気液噴出孔２２ｃ側へ移動していく。この際、液体には遠心力が働き、器体２２の中心部に気体自吸管２３から空気が流入し、負圧軸Ｙが形成される。また、負圧軸Ｙにより、気液噴出孔２２ｃ付近の液相１１の液体には、気体自吸管２３を絞ることにより微細気泡発生器２２内に進入しようとする力が働く（以下、この力が働く液体を負圧液という）。一方、微細気泡発生器２２内の気液混合流体は、旋回しながら気液噴出孔２２ｃに近づくにつれて、旋回速度が速くなり、気液噴出孔２２ｃ付近で旋回速度は最大となり、負圧液と押し合う状態になる。よって、負圧軸Ｙに集まった気体は、負圧液と旋回している気液混合流体とによって形成された間隙を圧縮気体となって通過し、多量の微細気泡として気液噴出孔２２ｃから液相１１へ噴出される。

【００３５】一方、水流管５に流入した気液混合流体は、実施の形態１と同様に水流ノズル６で水流用気体自吸管７からの空気と混合されて噴出され、液相１１に水流が発生し、微細気泡発生器２２の気液噴出孔２２ｃから噴出された微細気泡が広範囲に拡散される。

【００３６】以上のように構成された本発明の実施の形態２の水流式微細気泡発生装置によれば、以下のような作用が得られる。

（１）導入管２１から器体２２ａ内に気液混合流体でなく液体のみを流入させても、接線方向から器体２２ａ内に流入した液体には遠心力が働き、その分中心部が減圧になり、気体自吸管２３から自吸され流入し負圧軸Ｙが形成される。

（２）導入管２１から水流管５へ流入した気液混合流体は液相へ流れ込み、水流を形成する。この水流にのって、微細気泡発生器２２の気液噴出孔２２ｃから噴出された微細気泡が広範囲に拡散することができる。

（３）駆動部としては、ポンプ２を１基用いるだけで、微細気泡と水流を発生させることができる。

（４）ポンプ２のインペラやケーシング内に空気や反応装置に用いた場合に反応ガスが吸入されないので、ポンプがキャビテーションを起こすのを防止できる。

（５）気体は気体自吸管２３から直接微細気泡発生器２２内へ吸い込まれるので、反応装置に用いた場合に活性の反応ガス（例えば、ＨＣｌやフッ素化合物，$COCl_2$ 等）がポンプ２のケーシング内に入らないので、化学反応装置に用いてもポンプの耐久性を向上させることができる。

（６）ポンプ２の選択が液体の種別だけで選択でき、汎用性に優れる。

（７）液相１１が、活魚輸送用の水槽内である場合は、水槽内に酸素を供給しながら水流を起こすことにより、活魚が弱まるのを防止することができ、長時間の輸送が可能になる。

（８）先細り式水流発生ノズル６’の吸込み側と吐出側の内径の比や、吸込み側と吐出側の距離を適宜選択することにより所望の吐出量や吐出圧で吐出させることができる。

（９）先細り式水流発生ノズル６’は吐出側に向かって内径が小さくなるだけの単純な構造なので、メンテナンス性に優れるとともに耐久性に優れる。

【００３７】

【発明の効果】以上のように本発明の水流式微細気泡発生装置によれば、以下のような有利な効果が得られる。請求項１に記載の発明によれば、以下の効果を有する。

（１）導入管から器体内に高圧の気液混合流体を流入させると、接線方向から器体内に流入した気液混合流体は、器体の内壁面に沿って旋回し、激しく気液混合されながら、気液噴出孔側へ移動していく。この際、液体と気体との比重の差によって、液体には遠心力が働き、気体には向心力が働き、気体が中心軸に集束し負圧軸が形成される。また、負圧軸により、気液噴出孔付近の液相の液体には、微細気泡発生器内に進入しようとする力が働く（以下、この力が働く液体を負圧液という）。一方、微細気泡発生器内の気液混合流体は、旋回しながら気液噴出孔に近づくにつれて、旋回速度が速くなるとともに圧力が高くなり、気液噴出孔付近で旋回速度及び圧力は最大となり、負圧液と押し合う状態になる。負圧軸に集まった気体は、負圧液と旋回している気液混合流体とによって形成された間隙を圧縮気体となって剪断されながら通過し、気液混合流体とともに多量の微細気泡として気液噴出孔から液相へ噴出される。

（２）旋回しながら噴出される気液混合流体と負圧液とにより、負圧軸に集まった気体は圧縮・剪断され、引きちぎられるようにして噴出されるので、多量のナノメータ乃至マイクロメータオーダーの微細気泡を発生させることができる。

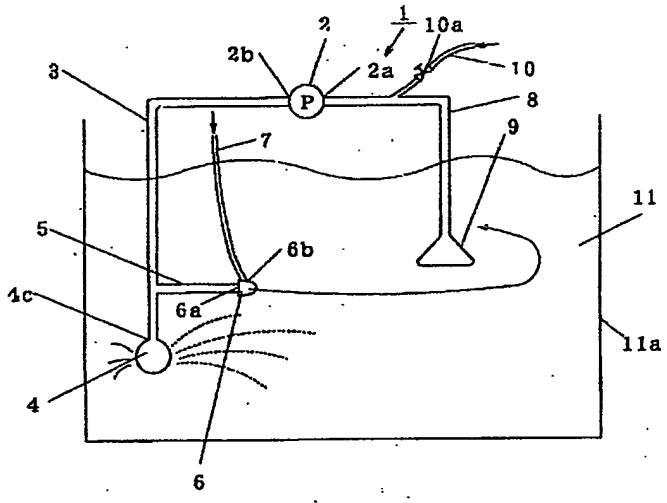
（３）導入管から水流管へ流入した気液混合流体は液相へ流れ込み、水流を形成する。この水流にのって、微細気泡が広範囲に拡散される。

（４）微細気泡発生用のポンプと水流発生用のポンプを別々に備える必要がなく、１機のポンプで微細気泡及び水流を発生させることができるので、生産性に優れるとともにメンテナンス性に優れる。

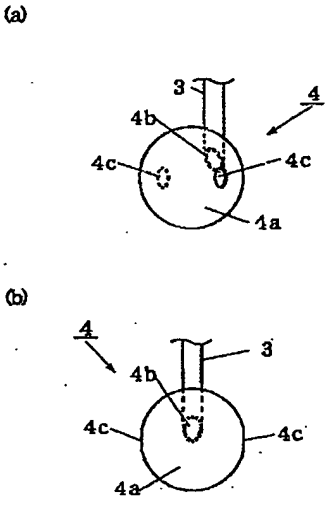
（５）微細気泡を多量に発生させるので、気体と液体の接触面積を大きくすることができ、気液反応装置における反応や、浄化装置における浄化を促進させることがで

3　導入管
4　微細気泡発生器
4a　器体
4b　導入孔
4c　気液噴出孔
5　水流管
6　水流発生ノズル
6'　先細り式水流発生ノズル
6a　水流用器体
6b　水流用吸込管
6c　水流用気体自吸孔
6d　水流用噴出孔
7　水流用気体自吸管
8　吸込管
9　ストレーナ
10　気体自吸管
10a　気体流量調整器
11　液相
11a　生簀
20　水流式微細気泡発生装置
21　導入管
22　水流式微細気泡発生器
22a　器体
22b　導入孔
22c　気液噴出孔
22d　気体自吸孔
23　気体自吸管

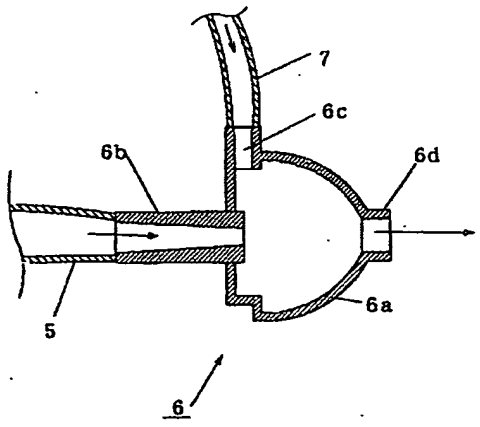
【図1】



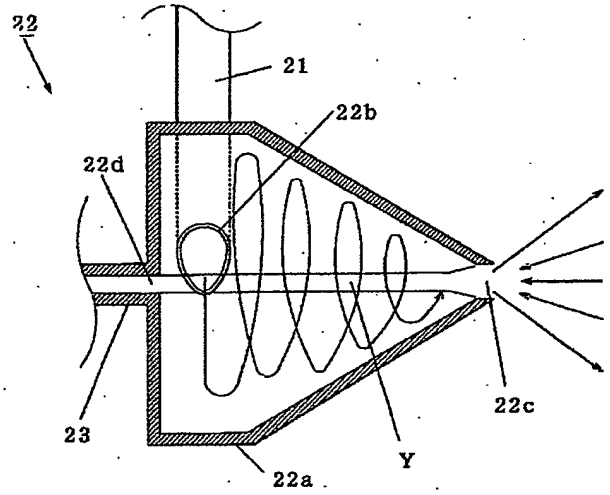
【図2】



【図3】



【図7】



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Texts in the figures are not translated and shown as it is.

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ictionary: Last updated 08/08/2008 / Priority:

LAIM + DETAILED DESCRIPTION

Claim(s)]

Claim 1] a. The vessel body which has the hollow part of the form which converges toward a ront end part from the rear side inside, The introductory hole arranged in tangential adjusting t the rear side of said vessel body, and the vapor-liquid jet hole arranged in the front end art of said vessel body, The stream type detailed air-bubbles generator characterized by aving the detailed bubble generator which is ****(ing), the introductory pipe by which the b. ower stream side was connected to said introductory hole, and the stream pipe with which it onnected with the predetermined part of the c. aforementioned introduction pipe, and the pening of the lower stream side was carried out.

Claim 2] The vessel body with which said detailed bubble generator has the hollow part of the orm which converges toward both ends from an intermediate part inside, The stream type letailed air-bubbles generator according to claim 1 characterized by having the vapor-liquid et hole drilled in the abbreviation symmetrical position centering on the introductory pipe which has the introductory hole which it is arranged in said intermediate part of said vessel ody by tangential adjusting, and carries out an opening within said vessel body, and said ntroductory pipe of said vessel body.

Claim 3] The stream type detailed air-bubbles generator according to claim 1 characterized y having the gas self-priming hole drilled by the back end part or rear wall of said detailed ubble generator, and the gas self-priming pipe with which the one end side was connected to aid gas self-priming hole, and the opening of the other end side was carried out.

Claim 4] It is a stream type detailed air-bubbles generator given in any or the first clause mong the Claims 1-3 characterized by having the stream generating nozzle arranged in the ower stream side of said stream pipe.

Claim 5] The pump which has a suction opening and a discharge mouth and by which the pper stream side of said introductory pipe was connected to said discharge mouth, It is a tream type detailed air-bubbles generator given in any or the first clause among the Claims , 2 and 4 characterized by having the suction pipe by which the lower stream side was onnected to said suction opening of said pump, and the gas self-priming pipe with which the ne end side was connected to the predetermined part of the aforementioned suction pipe, nd the opening of the other end side was carried out in gas.

Claim 6] The stream type detailed air-bubbles generator according to claim 3 or 4 haracterized by having the pump which has a suction opening and a discharge mouth, and by hich the upper stream side of said introductory pipe was connected to said discharge mouth, nd the suction pipe by which the lower stream side was connected to said suction opening of aid pump.

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the stream type detailed air-bubbles generator which makes the liquid phase of the vapor-liquid reaction vessel in the inside of the nursery of underwater [, such as a tank, Poole and an aeration tub, and a river,] or a culture pond, or the coast, or the water (sea water) of a fresh fish truck, or a chemical factory generate detailed air bubbles so much, and makes it diffuse the air bubbles by a stream.
[0002]
[Description of the Prior Art] The various detailed air-bubbles generators which aim at purification of a tank, a Poole, a river, etc., etc., the increase in dissolved oxygen, acquisition of the high massage effect in a bathtub, etc. are studied and developed by generating detailed air bubbles in recent years. As a conventional detailed air-bubbles generator, for example JP,2000-447,A (henceforth an I number gazette)] "The main part of a container which has a conic space, and the pressurization liquid feed port established by the tangential adjusting in a part of inner wall circumference side of this space, The revolution type detailed air-bubbles generator which it comes to consist of a gas introduction hole established by the space bottom of said cone and a revolution vapor-liquid derivation mouth established by the top part of the space of said cone" is indicated. Moreover, [JP,S63-74123,U (henceforth a RO number gazette)] "The suction massage air-bubbles jet stream equipment which opened in tangential adjusting the liquid supply hole of the ZETT pump which sends gas by a liquid jet stream along with the peripheral wall of the entrance of a nozzle, connected the mixing chamber with the exit of the nozzle, made the exit the jet orifice, and has prepared the projection of two or more pipes around it" is indicated.
[0003]
[Problem to be solved by the invention] However, the above-mentioned Prior art had the following technical problems.
1) Since technology given in an I number gazette and a RO number gazette was not equipped with the composition for generating a stream, it had a problem of the ability not to make it broadly spread towards a request of detailed air bubbles.
[0004] This invention solves the above-mentioned conventional technical problem, and A tank, and Poole, an aeration tub, It aims at offering the stream type detailed air-bubbles generator which can be made to generate detailed air bubbles so much and broadly with a stream in the liquid of the vapor-liquid reaction vessel in the inside of the nursery of underwater [, such as a river,] or a culture pond, or the coast, or the water (sea water) of a fresh fish truck, or a chemical factory.
[0005]
[Means for solving problem] In order to solve the above-mentioned technical problem, the stream type detailed air-bubbles generator of this invention has the following composition.
[0006] [the stream type detailed air-bubbles generator of this invention according to claim 1] a. The vessel body which has the hollow part of the form which converges toward a front end part from the rear side inside, The introductory hole arranged in tangential adjusting at the rear side of said vessel body, and the vapor-liquid jet hole arranged in the front end part of said vessel body, It has composition equipped with the detailed bubble generator which is **** ing), the introductory pipe by which the b. lower stream side was connected to said introductory hole, and the stream pipe with which it connected with the predetermined part of the c. aforementioned introduction pipe, and the opening of the lower stream side was carried out.

0007] The following operations are obtained by this composition.
1) If high-pressure vapor-liquid mixture fluid is made to flow in a vessel body from an ntroductory pipe, the vapor-liquid mixture fluid which flowed in the vessel body from angential adjusting moves to the vapor-liquid jet hole side, while it circles over the inner wall surface of a vessel body and vapor-liquid mixture is carried out violently. Under the present circumstances, of the difference of the specific gravity of a liquid and gas, centrifugal force works into a liquid, central force works into gas, gas converges on a main axis, and a negative pressure axis is formed. Moreover, into the liquid of the liquid phase near a vapor-liquid jet hole, the power which is going to advance into a detailed bubble generator works with a negative pressure axis (the liquid with which this power works is hereafter called negative pressure liquid). On the other hand, while revolution speed becomes quick, pressure becomes high, and revolution speed and pressure serve as the maximum near a vapor-liquid jet hole, and it will be in the state of pushing one another with negative pressure liquid as the vapor-liquid mixture fluid in a detailed bubble generator approaches a vapor-liquid jet hole, circling. The gas gathering in a negative pressure axis passes through the gap formed of negative pressure liquid and the vapor-liquid mixture fluid which is circling, becoming compression gas and being sheared, and blows off from a vapor-liquid jet hole to the liquid phase as a lot of detailed air bubbles with vapor-liquid mixture fluid.
2) Since compress and shear the gas gathering in a negative pressure axis, it is torn off, it makes and it blows off with the vapor-liquid mixture fluid blowing off and negative pressure liquid, circling, the detailed air bubbles of a lot of NANOMETA or micrometer orders can be generated.
3) The vapor-liquid mixture fluid which flowed into the stream pipe from the introductory pipe flows into the liquid phase, and forms a stream. It is in this stream and detailed air bubbles diffuse broadly.
4) Since it is not necessary to have separately a pump for detailed air-bubbles generating, and a pump for stream generating and detailed air bubbles and a stream can be generated by one set of a pump, while excelling in productivity, excel in maintenance nature.
5) Since detailed air bubbles are generated so much, the contact surface product of gas and a liquid can be enlarged and the reaction in a vapor-liquid reaction apparatus and the purification in a purifying facility can be promoted. Moreover, the amount of dissolved oxygen in the water (sea water) of a culture pond, a nursery, or a live fish truck can be made to increase.
0008] Here, as a vessel body, the thing of the shape of a cone, truncated cone form, hemisphere form, and artillery shell form etc. is used. Since it has the form which a vessel body converges at a stretch toward a vapor-liquid jet hole from an introductory hole when the vessel body of the shape of a cone and truncated cone form is used, rapid shearing force can work in the fluid which circles in the inside of a vessel body, and fluid with high viscosity can also be made to fully agitate. Moreover, the thing of polygon [of a triangle, crossroads, etc.], circular, and ellipse type [form / of a vapor-liquid jet hole] is used. When it is made circular, homogeneous detailed air bubbles can be obtained. The flow velocity of the fluid breathed out from the particle diameter and stream pipe of the air bubbles which blow off from a vapor-liquid jet hole is suitably chosen by the revolution speed based on the ratio of the tube diameter of an introductory pipe or a stream pipe, or the form of a vessel body. As form of a stream pipe, tubular [mere], the form to which an inside diameter becomes small gradually toward the lower stream side, etc. are used. Moreover, a stream pipe is arranged towards the direction which wants to diffuse detailed air bubbles in the end by the side of the lower stream. Although the part style ratio of the vapor-liquid mixture fluid of an introductory pipe

ind a stream pipe changes with the pressure and the flow velocities of fluid which are ntroduced into an introductory pipe, the part style ratio by the side of a stream pipe is hunted in 5 to 80% of range. The flow velocity of ****** is weak and the diffusion range of letailed air bubbles is narrow as a part style ratio becomes less than 5%, and since the endency for the yield of detailed air bubbles to decrease is accepted as 80% is exceeded, it is ot desirable. Although the aperture ratio of an introductory hole and a vapor-liquid jet hole is uitably chosen by the pressure and the flow velocity of introductory fluid of an introductory ipe, when taking the large yield and large diffusion range of detailed air bubbles, the caliber of n introductory hole is made larger than the caliber of a vapor-liquid jet hole.

0009] The vessel body which has the hollow part of the form on which invention of this nvention according to claim 2 is a stream type detailed air-bubbles generator according to laim 1, and said detailed bubble generator converges toward both ends from an intermediate art inside, It has composition equipped with the vapor-liquid jet hole drilled in the bbreviation symmetrical position centering on the introductory pipe which has the ntroductory hole which it is arranged in said intermediate part of said vessel body by angential adjusting, and carries out an opening within said vessel body, and said introductory ipe of said vessel body.

0010] In addition to an operation of Claim 1, the following operations are obtained by this omposition.

1) Since the vapor-liquid jet hole is drilled in the position symmetrical with abbreviation entering on the introductory pipe of a vessel body, a lot of detailed air bubbles can be more roadly diffused from the both sides of a vessel body.

2) Since it has two vapor-liquid jet holes, the particle diameter of detailed air bubbles can be djusted easily.

3) The rate of incidence of detailed air bubbles can be raised remarkably.

lere, as a vessel body, form, the shape of a globular form, the egg-shaped thing that made a one or the bottoms of the truncated cone open for free passage are used. Since it has the orm which a vessel body converges at a stretch toward a vapor-liquid jet hole from an ntroductory hole when the vessel body of the form which made a cone or the bottoms of the runcated cone open for free passage is used, rapid shearing force can work in the fluid which ircles in the inside of a vessel body, and fluid with high viscosity can also be made to fully gitate. Moreover, the flow velocity of the fluid breathed out from the quantity and the stream ipe of the air bubbles which blow off from a vapor-liquid jet hole is suitably chosen by the evolution speed based on the ratio of the tube diameter of an introductory pipe or a stream ipe, or the form of a vessel body.

0011] Invention of this invention according to claim 3 is a stream type detailed air-bubbles enerator according to claim 1, and has composition equipped with the gas self-priming hole rilled by the back end part or rear wall of said detailed bubble generator, and the gas self-riming pipe with which the one end side was connected to said gas self-priming hole, and the pening of the other end side was carried out.

0012] In addition to an operation of Claim 1, the following operations are obtained by this omposition.

1) Even if it makes only the liquid instead of vapor-liquid mixture fluid flow in a vessel body rom an introductory pipe, centrifugal force works into the liquid which flowed in the vessel ody from tangential adjusting, the central part serves as negative pressure, gas flows into the art central part from a gas self-priming pipe, and a negative pressure axis is formed.

2) A gas self-priming pipe can be wide opened to the atmosphere, or gas can be made to bsorb or react to a liquid only by connecting with the absorption or reactant gas (for

example, other reactant gas, such as CO2, HCl, HCN, SO2, COCl2, and fluorine compound gas) made into the purpose.

[0013] Here, the amount of suction of the gas to a pump is performed out of the range which starts the cavitation of a pump. Furthermore, since gaseous high diffusion-ization is attained, suction of gas has the desirable direction performed to the one where the viscosity of a liquid is lower. A stream type detailed air-bubbles generator Moreover, purification of a water purification plant or a river, purification of stock raising urination, The oxygen supply at the time of transportation of live fish, and culture etc., the increase in the amount of dissolved oxygen at the time of hydroponics, It is used for the dissolution by the fermentation of removal of the contamination water disposal by surfacing of sludge etc., and the bleaching powder of a water tank, sterilization by ozone mixture, sterilization, deodorization, the blood circulation promotion at the time of bathing, a washing machine, and fermented foods and promotion of cultivation, and high-density contact of various medicine and various gas and neutralization, a face syringe, a shower, an injection-of-fuel machine, etc. Arranging a stream type detailed air-bubbles generator in the tank for live fish transportation, and supplying oxygen in a tank especially, by starting a stream, it can delay that live fish becomes weaker and prolonged transportation is attained. The amount of air bubbles which blows off by choosing suitably a gas self-priming hole, the inside diameter of a gas self-priming pipe, and the discharge pressure of a pump is determined. When connecting a gas self-priming pipe to the gas tub which has pressure, such as reactant gas, it is desirable to be set up lower than the pressure of the fluid of an introductory pipe. It is because it becomes difficult to attain a gaseous miniaturization. Since it not only can adjust the amount of jet of detailed air bubbles free, but the particle diameter of detailed air bubbles can be adjusted when a flow instrument and a flow control machine are arranged in a gas self-priming pipe, it is desirable to be arranged depending on the capacity and the setting position of a stream type detailed air-bubbles generator.

[0014] Invention of this invention according to claim 4 is a stream type detailed air-bubbles generator given in any or the first clause among Claims 1-3, and has composition equipped with the stream generating nozzle arranged in the lower stream side of said stream pipe.

[0015] In addition to an operation of any or the first clause, by this composition, the following operations are obtained among Claims 1-3.

(1) Since the stream generating nozzle is installed, vigor can be attached to the flow velocity of the liquid which flows out of a stream pipe, or vapor-liquid mixture fluid, and detailed air bubbles can be diffused more broadly.

(2) Mixed churning of the liquid phase can be carried out, and gaseous dissolution spots can be stopped.

[0016] Here, as a stream generating nozzle, a point thin nozzle, the thing which takes in gas as a company style, etc. are used. When a point thin nozzle is used, detailed air bubbles can be conveyed to a distant place. Moreover, when what takes in gas as a company style is used, the mixed churning effect of the liquid phase can be acquired.

[0017] The pump which has a suction opening and a discharge mouth and by which invention of this invention according to claim 5 was a stream type detailed air-bubbles generator given in any or the first clause among Claims 1, 2 and 4, and the upper stream side of said introductory pipe was connected to said discharge mouth, The lower stream side has composition equipped with the suction pipe connected to said suction opening of said pump, and the gas self-priming pipe with which the one end side was connected to the predetermined part of the aforementioned suction pipe, and the opening of the other end side was carried out in gas.

)018] In addition to an operation of any or the first clause, by this composition, the following perations are obtained among Claims 1, 2 and 4.
1) If a pump is made to drive, gas will be inhaled in a suction pipe considering the inside of a uction pipe as a company style of flowing fluid from a gas self-priming pipe, and it will ecome vapor-liquid mixture fluid, and will flow into a vessel body.
2) Since the gas inhaled from the gas self-priming pipe flows into a vessel body after diffusing : to some extent by IMPERA in a pump, it can generate more detailed air bubbles.
3) Since it is not necessary to have separately a pump for detailed air-bubbles generating, nd a pump for stream generating and detailed air bubbles and a stream can be generated by ne set of a pump, while excelling in productivity, excel in maintenance nature.
4) Since gas flows not only the inside of a detailed bubble generator but in a stream pipe, the etailed air bubbles which blow off from a detailed bubble generator, and the big air bubbles /hich blow off from a stream pipe can be made to blow off. Big air bubbles surface omparatively immediately, after blowing off from a stream pipe, and after blowing off, detailed ir bubbles surface compared with big air bubbles, after [long] carrying out distance ıovement. Therefore, in the distance near the detailed air-bubbles generator, detailed air ubbles can be diffused for big air bubbles.
0019] Here, since the flux of the liquid which flows through the inside of a suction pipe by hanging the tube diameter of a suction pipe and the capability of a pump changes, the uantity of gas inhaled in a suction pipe can be changed. Moreover, the amount of suction of he gas to a pump is performed out of the range which starts the cavitation of a pump. When ı flow control machine and a flow instrument are arranged in a gas self-priming pipe, the bove-mentioned effect can be acquired.
0020] Invention of this invention according to claim 6 is a stream type detailed air-bubbles enerator according to claim 3 or 4, and has composition equipped with the pump which has a uction opening and a discharge mouth and by which the upper stream side of said ıtroductory pipe was connected to said discharge mouth, and the suction pipe by which the ower stream side was connected to said suction opening of said pump.
0021] In addition to Claim 3 or an operation of 4, the following operations are obtained by this omposition.
1) If a pump is made to drive, fluid will flow into an introductory pipe or a stream pipe through ı pump from a suction pipe.
2) Since it is not necessary to have separately a pump for detailed air-bubbles generating, ınd a pump for stream generating and detailed air bubbles and a stream can be generated by ne set of a pump, while excelling in productivity, excel in maintenance nature.
3) Since neither air nor reactant gas is inhaled in IMPERA of a pump, or a casing, it can revent that a pump starts a cavitation.
4) Since the reactant gas (for example, HCl, a fluorine compound, COCl2, etc.) of activity loes not enter in the casing of a pump, the endurance of a pump can be raised.
5) Selection of a pump can choose only by the classification of a liquid and is excellent in lexibility.
6) When a detailed bubble generator and a suction pipe are thrown into the same liquid phase, while raising a gaseous dissolved rate remarkably, the liquid phase can be agitated and gaseous absorption efficiency and a gaseous reaction rate can be raised remarkably.
0022]
Mode for carrying out the invention] (Form 1 of operation) The stream type detailed air-ubbles generator in the form 1 of operation of this invention is explained, referring to Drawings below.

0023] Drawing 1 is the constitutional diagram showing the state where the stream type detailed air-bubbles generator in the form 1 of operation of this invention was installed in the fish preserve. A stream type detailed air-bubbles generator [in / on drawing 1 and / in 1 / the form 1 of operation of this invention], The pump with which 2 has a suction opening 2a and the discharge mouth 2b, the introductory pipe by which, as for 3, the upper stream side was connected to the discharge mouth 2b of a pump 2, The stream pipe to which the detailed bubble generator by which 4 was connected to the lower stream side of the introductory pipe 3, and 5 were connected by the upper stream side branching in the predetermined part of the introductory pipe 3, The stream generating nozzle by which the lower stream side of the stream pipe 5 was connected to the gas self-priming hole 6a for streams 6, The gas self-priming pipe for streams with which one end was connected to the gas self-priming hole 6b for streams of the stream generating nozzle 6 7, and the opening of the other end side was carried out in the atmosphere, The suction pipe by which, as for 8, the lower stream side was connected to the suction opening 2a of a pump 2, the strainer with which 9 was arranged in the upper stream side of the suction pipe 8, The gas self-priming pipe with which the one end side branched in the predetermined part of the suction pipe 8, 10 was connected, and the opening of the other end side was carried out in the atmosphere, the gas flow control machine with which 10a was arranged in the predetermined part of the gas self-priming pipe 10, and 11 are the liquid phase of the tank in which the detailed air-bubbles generator 1 was arranged, a fish preserve 11a, etc.

0024] Drawing 2 (a) is the important section perspective view of the detailed bubble generator in the form 1 of operation of this invention, drawing 2 (b) is the front view, and drawing 2 (c) is the important section side view. the vessel body which has the hollow part of the form (abbreviation hollow — spherical) on which 3 faces to an introductory pipe, 4 faces to a detailed bubble generator, 4a goes to both ends from an intermediate part, and an inside converges in drawing 2 — The introductory hole of the introductory pipe 3 with which the opening of the 4b was carried out to the vessel body 4a in tangential adjusting, and 4c are the vapor-liquid jet holes drilled in the both ends of the diameter direction which intersects perpendicularly in the straight line turned to the central part from the introductory hole 4b of the vessel body 4a, and the central part.

0025] Drawing 3 is the side sectional view showing an example of the stream generating nozzle in the form 1 of operation of this invention. In drawing 3 , as for 5, a stream generating nozzle and 7 are the gas self-priming pipes for streams a stream pipe and 6, and since these are the same as that of drawing 1 , they attach the same mark and omit the explanation. the stream which 6a makes accelerate the fluid which flowed from the rear, and carries out discharge from the front part side — an instrument — the body and 6b — a stream — an instrument — it is the suction pipe for streams which has the form from which arrangement fixation was carried out and opening area was gradually extracted to the back end part of Body 6a toward the front part side. The downstream side edge part of the stream pipe 5 is connected to the suction pipe 6b for streams. The gas self-priming hole for streams in which 6c was drilled by the side wall of the vessel body 6a for streams, and 6d are the jet holes for streams drilled in the front end part of the water appropriation vessel body 6a by the suction pipe 6b for streams, and the abbreviation same axle. The fluid which flows into the stream generating nozzle 6 from the stream pipe 5 passes accelerating the suction pipe 6b for streams, flows into the water appropriation vessel body 6a, and blows off from 6d of jet holes for streams. As a company style of this fluid, air flows into the water appropriation vessel body 6a through the gas self-priming hole 6c for streams from the gas self-priming pipe 7 for streams, and it blows off from 6d of jet holes for streams with the fluid from the suction pipe

3b for streams.

[0026] The operation is explained about the stream type detailed air-bubbles generator in the form 1 of operation of this invention constituted as mentioned above, referring to Drawings below. Drawing 4 is the important section front constitutional diagram showing the state of the fluid inside the detailed bubble generator in the form 1 of operation of this invention. In drawing 4 , as for a detailed bubble generator and 4a, 3 is [an introductory hole and 4c of a vessel body and 4b] vapor-liquid jet holes an introductory pipe and 4, and since these are the same as that of drawing 2 , they attach the same mark and omit the explanation. X is a negative pressure axis formed of the specific gravity difference of the gas of vapor-liquid mixture fluid and the liquid which circle in the inside of the detailed bubble generator 4. In drawing 1 , if a pump 2 is made to drive, the liquid of the liquid phase 11 will flow into the suction pipe 8 through a strainer 9. In a terminal area with the gas self-priming pipe 10 of the suction pipe 8, air is attracted as a company style of a liquid from the gas self-priming pipe 10 in the suction pipe 8, and it becomes vapor-liquid mixture fluid, and inhales in a pump 2 from the suction opening 2a of a pump 2. The vapor-liquid mixture fluid inhaled in the pump 2 is breathed out by IMPERA (not shown) of a pump 2 in the introductory pipe 3 from the discharge mouth 2b of a pump 2, while air bubbles diffuse. The vapor-liquid mixture fluid which flowed into the introductory pipe 3 branches and flows into the detailed bubble generator 4 and the stream pipe 5.

[0027] In drawing 4 , when the high-pressure vapor-liquid mixture fluid which flowed in the detailed bubble generator 4 from tangential adjusting through the introductory hole 4b circles over the inner wall surface of a vessel body 4a from the introductory pipe 3, while vapor-liquid mixture is carried out violently, it moves to the vapor-liquid jet hole 4c side. Under the present circumstances, of the difference of the specific gravity of a liquid and gas, centrifugal force works into a liquid and the negative pressure axis X which central force works and consists of the decompressed empty gaseous phase is formed in air. Moreover, into the liquid of the liquid phase 11 near vapor-liquid jet hole 4c, the power which is going to advance into the detailed bubble generator 4 works with the negative pressure axis X (the liquid with which this power works is hereafter called negative pressure liquid). On the other hand, revolution speed becomes quick, revolution speed serves as the maximum near vapor-liquid jet hole 4c, and it will be in the state of pushing one another with negative pressure liquid as the vapor-liquid mixture fluid in the detailed bubble generator 4 approaches the vapor-liquid jet hole 4c, circling. Therefore, as the gas gathering in the negative pressure axis X passes through between negative pressure liquid and the vapor-liquid mixture fluid which is circling, being compressed and sheared and meets the surface of a sphere of the detailed bubble generator 4, it blows off from the vapor-liquid jet hole 4c to the liquid phase 11 as detailed air bubbles of a lot of NANOMETA or micrometer orders.

[0028] On the other hand, in drawing 3 , it is accelerated by the stream generating nozzle 6, and the vapor-liquid mixture fluid which flowed into the stream pipe 5 blows off in the liquid phase 11. Thereby, a stream occurs in the liquid phase 11, and the detailed air bubbles which blew off from the vapor-liquid jet hole 4c of the detailed bubble generator 4 are carried to this stream to a distant place, and diffuse broadly.

[0029] In addition, in the form 1 of this operation, although the spherical detailed bubble generator 4 with the vapor-liquid jet hole 4c of two lots was used, even if a vapor-liquid jet hole uses hemisphere form, artillery shell form, truncated cone form, and a conic detailed bubble generator by one lot, it can carry out similarly. Moreover, although it had composition which makes gas flow in the stream generating nozzle 6 in the form 1 of this operation using the stream generating nozzle 6 which has the gas self-priming hole 6c for streams Since the

fluid from the stream pipe 5 can be accelerated even if it only connects the pipe of form with which an inside diameter becomes small gradually toward the front part side from the rear side, it can carry out similarly. Moreover, although fluid may be made to flow in the liquid phase 11 from the direct stream pipe 5 not using the stream generating nozzle 6, by processing making the inside diameter of a downstream side edge part smaller than the upper stream side etc. into the stream pipe 5 even in this case, fluid can be accelerated and a large area can be diffused to a distant place. Moreover, although the form 1 of this operation explained the fish preserve, it can carry out similarly about various equipment, such as a septic tank, a precipitation pond, chemical reaction equipment, and an aeration tub, or equipment.

[0030] According to the stream type detailed air-bubbles generator of the form 1 of operation of this invention constituted as mentioned above, the following operations are obtained.

1) Since the vapor-liquid jet hole 4c is drilled in the center line of the symmetrical position of both sides focusing on the gas introduction hole 4b by the vessel body 4a of the detailed bubble generator 4, detailed air bubbles can be made to blow off from the both sides of the detailed bubble generator 1 broadly to it.

2) Since the gas gathering in the negative pressure axis X is sheared being compressed with negative pressure liquid when it blows off, a lot of [that it is more detailed and] air bubbles can be made to blow off.

3) Since the gas inhaled from the gas self-priming pipe 10 flows into a vessel body 4a after diffusing it to some extent by IMPERA in a pump 2, it can generate more detailed air bubbles.

4) The vapor-liquid mixture fluid which flowed into the stream pipe 5 from the introductory pipe 3 is injected to the liquid phase, and forms a stream into the liquid phase. It is in this stream and the detailed air bubbles which blew off from the vapor-liquid jet hole 4c of the detailed bubble generator 4 diffuse in a large area to a distant place.

5) Since the stream generating nozzle 6 is installed in the lower stream side of the stream pipe 5, vigor can be attached to the stream of the liquid which flows out of the stream pipe 5, or vapor-liquid mixture fluid, and detailed air bubbles can be more broadly diffused to a distant place.

6) Since it is not necessary to have separately a pump for detailed air-bubbles generating, and a pump for stream generating and detailed air bubbles and a stream can be generated by one set of a pump 2, while excelling in productivity, excel in maintenance nature.

7) Big air bubbles are contained in the fluid which blows off from the stream generating nozzle 6 compared with the detailed air bubbles which blow off from the detailed bubble generator 4, and since these are not diffused to a distant place compared with detailed air bubbles, they can diffuse air bubbles also near the equipment.

8) Since there are no fine pores for taking in gas etc. in the detailed bubble generator 4 even f fluid flows backwards with the ** pressure in equipment (negative pressure) at the time of ON/OFF of a pump etc. when the detailed bubble generator 4 is used for a vapor-liquid reaction apparatus, a sewage treatment unit, etc., raise a **** ball with neither a reaction thing nor filth.

9) Since there are no fine pores for taking in gas etc. in the detailed bubble generator 4, even f it makes the inside of a vessel body 4a into high pressure, an adverse current cannot be caused at the time of a stop, but a lot of [that it is more detailed and] air bubbles can be made to blow off.

10) Since detailed air bubbles are generated so much, the contact surface product of gas and a liquid can be enlarged and the reaction in a vapor-liquid reaction apparatus and the purification in a purifying facility can be promoted. Moreover, the amount of dissolved oxygen

n the water (sea water) of a culture pond, a nursery, or a fresh fish truck can be made to ncrease remarkably.

11) when the liquid phase 11 is a tank for live fish transportation Since the air bubbles of air being detailed (micrometer order)] or oxygen are diffused in the whole tank and the dissolved oxygen content in the liquid phase (Wed.) can be raised to it by starting a stream, supplying air and oxygen in a tank, it can make it late that live fish becomes weaker, and prolonged transportation is attained.

12) Since detailed air bubbles can be diffused to a distant place, it is efficient and water quality purification of a pond, a river, etc. can be carried out.

13) Since gas is made overly detailed and it can high-distribute in the liquid phase, the reactant gas in a detailed evaporation study factory etc., washing of exhaust gas, absorption, and removal can be performed easily.

14) Since it has the gas flow control machine 10, it not only can adjust the amount of jet of detailed air bubbles free, but it can adjust the particle diameter of detailed air bubbles.

0031] (Form 2 of operation) The stream type detailed air-bubbles generator in the form 2 of operation of this invention is explained, referring to Drawings below.

0032] Drawing 5 is the composition figure of the stream type detailed air-bubbles generator n the form 2 of operation of this invention. In drawing 5 , as for a suction opening and 2b, as for the gas self-priming pipe for streams, and 8, a discharge mouth and 5 are [a strainer and 11] the liquid phase a suction pipe and 9 a stream pipe and 7, since 2 is a pump and these are the same as that of the form 1 of operation, they attach the same mark and 2a omits the explanation. A stream type detailed air-bubbles generator [in / 6' can be set for a tapering type stream generating nozzle, and / in 20 / the form 2 of operation of this invention], The ntroductory pipe for which the upper stream side was connected to the discharge mouth 2b of a pump 2 21, the detailed bubble generator in the form 2 of operation of this invention by which the introductory hole 22b was connected to the lower stream side of the introductory pipe 21 22, 23 is the gas self-priming pipe with which the one end side was connected to 22d of gas self-priming holes of the detailed bubble generator 22, and the opening of the other end side was carried out in the atmosphere (gaseous phase).

0033] Drawing 6 (a) is the important section perspective view of the detailed bubble generator in the form 2 of operation of this invention, drawing 6 (b) is the front view, and drawing 6 (c) is the important section side view. The vessel body which has the hollow part of the form (abbreviation truncated cone form and the shape of an abbreviation cone) which 21 faces to an introductory pipe, 22 faces to a stream type detailed bubble generator, and 22a goes to a front end part from the rear side, and converges, They are the introductory hole of the introductory pipe 21 with which the opening of the 22b was carried out to the trapezoid-like part of the vessel body 22a inside in tangential adjusting, the vapor-liquid jet hole by which 22c was drilled at the tip of a vessel body 22a, and the gas self-priming hole to which 22d was drilled by the rear wall of the vessel body 22a, and the gas self-priming pipe 23 was connected.

0034] The operation is explained about the stream type detailed air-bubbles generator in the form 2 of operation of this invention constituted as mentioned above, referring to Drawings below. Drawing 7 is the important section section constitutional diagram showing the state of the fluid inside the detailed bubble generator in the form 2 of operation of this invention. In drawing 7 , 21, as for a gas self-priming hole and 23, a detailed bubble generator and 22a of an ntroductory hole and 22c are [a vessel body and 22b] gas self-priming pipes an introductory pipe and 22, and since these are the same as that of drawing 6 , they attach the same mark and omit the explanation. [of a vapor-liquid jet hole and 22d] Y is a negative pressure axis

formed of the specific gravity difference of the gas of vapor-liquid mixture fluid and the liquid which circle in the inside of the detailed bubble generator 22. In drawing 5 , if a pump 2 is made to drive, the liquid of the liquid phase 11 will flow into the introductory pipe 3 through a strainer 9, the suction pipe 8, and a pump 2. The vapor-liquid mixture fluid which flowed into the introductory pipe 3 branches and flows into the detailed bubble generator 22 and the stream pipe 5. In drawing 7 , while the high-pressure vapor-liquid mixture fluid which flowed in the detailed bubble generator 22 from tangential adjusting through the introductory hole 22b circles over the inner wall surface of a vessel body 22a from the introductory pipe 21, it moves to the vapor-liquid jet hole 22c side. Under the present circumstances, centrifugal force works into a liquid, air flows into the central part of a vessel body 22 from the gas self-priming pipe 23, and the negative pressure axis Y is formed. Moreover, the power which is going to advance into the detailed bubble generator 22 works by extracting the gas self-priming pipe 23 to the liquid of the liquid phase 11 near vapor-liquid jet hole 22c with the negative pressure axis Y (the liquid with which this power works is hereafter called negative pressure liquid). On the other hand, revolution speed becomes quick, revolution speed serves as the maximum near vapor-liquid jet hole 22c, and it will be in the state of pushing one another with negative pressure liquid as the vapor-liquid mixture fluid in the detailed bubble generator 22 approaches the vapor-liquid jet hole 22c, circling. Therefore, the gas gathering in the negative pressure axis Y turns into compression gas, passes through the gap formed of negative pressure liquid and the vapor-liquid mixture fluid which is circling, and blows off from the vapor-liquid jet hole 22c to the liquid phase 11 as a lot of detailed air bubbles.

[0035] On the other hand, like the form 1 of operation, it is mixed with the air from the gas self-priming pipe 7 for streams, and blows off with the stream nozzle 6, a stream occurs in the liquid phase 11, and the detailed air bubbles which blew off from the vapor-liquid jet hole 22c of the detailed bubble generator 22 diffuse broadly the vapor-liquid mixture fluid which flowed into the stream pipe 5.

[0036] According to the stream type detailed air-bubbles generator of the form 2 of operation of this invention constituted as mentioned above, the following operations are obtained.

(1) Even if it makes only the liquid instead of vapor-liquid mixture fluid flow in a vessel body 22a from the introductory pipe 21, centrifugal force works into the liquid which flowed in the vessel body 22a from tangential adjusting, the part central part is decompressed, a self-priming **** inflow is carried out from the gas self-priming pipe 23, and the negative pressure axis Y is formed.

(2) The vapor-liquid mixture fluid which flowed into the stream pipe 5 from the introductory pipe 21 flows into the liquid phase, and forms a stream. It can be in this stream and the detailed air bubbles which blew off from the vapor-liquid jet hole 22c of the detailed bubble generator 22 can diffuse broadly.

(3) As an actuator, a pump 2 is only used one set and detailed air bubbles and a stream can be generated.

(4) Since reactant gas is not inhaled when it uses for air or a reaction apparatus into IMPERA of a pump 2, or a casing, it can prevent that a pump starts a cavitation.

(5) since gas is directly inhaled into the detailed bubble generator 22 from the gas self-priming pipe 23 Since the reactant gas (for example, HCl, a fluorine compound, COCl2, etc.) of activity does not enter in the casing of a pump 2 when it uses for a reaction apparatus, the endurance of a pump can be raised even if it uses for chemical reaction equipment.

(6) Selection of a pump 2 can choose only by the classification of a liquid, and is excellent in flexibility.

(7) When the liquid phase 11 is in the tank for live fish transportation, supplying oxygen in a

:ank, by starting a stream, it can prevent that live fish becomes weaker and prolonged :ransportation is attained.

8) It can be made to breathe out with the desired amount of discharge and discharge ›ressure by choosing suitably the ratio of the inside diameter by the side of suction of :apering type stream generating nozzle 6' and discharge, and the distance by the side of ;uction and discharge.

9) Tapering type stream generating nozzle 6' is excellent in endurance while it is excellent in naintenance nature, since the inside diameter is the simple structure which becomes small :oward the discharge side.

:0037]

:Effect of the Invention] According to the stream type detailed air-bubbles generator of this nvention, the following advantageous effects are acquired as mentioned above. According to nvention according to claim 1, it has the following effects.

:1) If high-pressure vapor-liquid mixture fluid is made to flow in a vessel body from an ntroductory pipe, the vapor-liquid mixture fluid which flowed in the vessel body from :angential adjusting moves to the vapor-liquid jet hole side, while it circles over the inner wall ;urface of a vessel body and vapor-liquid mixture is carried out violently. Under the present ;ircumstances, of the difference of the specific gravity of a liquid and gas, centrifugal force vorks into a liquid, central force works into gas, gas converges on a main axis, and a negative ›ressure axis is formed. Moreover, into the liquid of the liquid phase near a vapor-liquid jet ıole, the power which is going to advance into a detailed bubble generator works with a ıegative pressure axis (the liquid with which this power works is hereafter called negative ›ressure liquid). On the other hand, while revolution speed becomes quick, pressure becomes ıigh, and revolution speed and pressure serve as the maximum near a vapor-liquid jet hole, ınd it will be in the state of pushing one another with negative pressure liquid as the vapor-iquid mixture fluid in a detailed bubble generator approaches a vapor-liquid jet hole, circling. The gas gathering in a negative pressure axis passes through the gap formed of negative ›ressure liquid and the vapor-liquid mixture fluid which is circling, becoming compression gas ınd being sheared, and blows off from a vapor-liquid jet hole to the liquid phase as a lot of detailed air bubbles with vapor-liquid mixture fluid.

:2) Since compress and shear the gas gathering in a negative pressure axis, it is torn off, it nakes and it blows off with the vapor-liquid mixture fluid blowing off and negative pressure iquid, circling, the detailed air bubbles of a lot of NANOMETA or micrometer orders can be ;enerated.

:3) The vapor-liquid mixture fluid which flowed into the stream pipe from the introductory pipe lows into the liquid phase, and forms a stream. It is in this stream and detailed air bubbles diffuse broadly.

:4) Since it is not necessary to have separately a pump for detailed air-bubbles generating, ınd a pump for stream generating and detailed air bubbles and a stream can be generated by ›ne set of a pump, while excelling in productivity, excel in maintenance nature.

:5) Since detailed air bubbles are generated so much, the contact surface product of gas and ı liquid can be enlarged and the reaction in a vapor-liquid reaction apparatus and the ›urification in a purifying facility can be promoted. Moreover, the amount of dissolved oxygen n the water (sea water) of a culture pond, a nursery, or a live fish truck can be made to ncrease.

:0038] According to invention according to claim 2, in addition to the effect of Claim 1, it has :he following effects.

:1) Since the vapor-liquid jet hole is drilled in the position symmetrical with abbreviation

centering on the introductory pipe of a vessel body, a lot of detailed air bubbles can be more broadly diffused from the both sides of a vessel body.

(2) Since it has two vapor-liquid jet holes, the particle diameter of detailed air bubbles can be adjusted easily.

(3) The rate of incidence of detailed air bubbles can be raised remarkably.

[0039] According to invention according to claim 3, in addition to the effect of Claim 1, it has the following effects.

(1) Even if it makes only the liquid instead of vapor-liquid mixture fluid flow in a vessel body from an introductory pipe, centrifugal force works into the liquid which flowed in the vessel body from tangential adjusting, the central part serves as negative pressure, gas flows into the part central part from a gas self-priming pipe, and a negative pressure axis is formed.

(2) A gas self-priming pipe can be wide opened to the atmosphere, or gas can be made to absorb or react to a liquid only by connecting with the absorption or reactant gas (for example, other reactant gas, such as CO2, HCl, HCN, SO2, COCl2, and fluorine compound gas) made into the purpose.

[0040] According to invention according to claim 4, in addition to the effect of any or the first clause, it has the following effects among Claims 1-3.

(1) Since the stream generating nozzle is installed, vigor can be attached to the flow velocity of the liquid which flows out of a stream pipe, or vapor-liquid mixture fluid, and detailed air bubbles can be diffused more broadly.

(2) Mixed churning of the liquid phase can be carried out, and gaseous dissolution spots can be stopped.

[0041] According to invention according to claim 5, in addition to the effect of any or the first clause, it has the following effects among Claims 1, 2 and 4.

(1) If a pump is made to drive, gas will be inhaled in a suction pipe considering the inside of a suction pipe as a company style of flowing fluid from a gas self-priming pipe, and it will become vapor-liquid mixture fluid, and will flow into a vessel body.

(2) Since the gas inhaled from the gas self-priming pipe flows into a vessel body after diffusing it to some extent by IMPERA in a pump, it can generate more detailed air bubbles.

(3) Since it is not necessary to have separately a pump for detailed air-bubbles generating, and a pump for stream generating and detailed air bubbles and a stream can be generated by one set of a pump, while excelling in productivity, excel in maintenance nature.

(4) Since gas flows not only the inside of a detailed bubble generator but in a stream pipe, the detailed air bubbles which blow off from a detailed bubble generator, and the big air bubbles which blow off from a stream pipe can be made to blow off. Big air bubbles surface comparatively immediately, after blowing off from a stream pipe, and after blowing off, detailed air bubbles surface compared with big air bubbles, after [long] carrying out distance movement. Therefore, in the distance near the detailed air-bubbles generator, detailed air bubbles can be diffused for big air bubbles.

[0042] According to invention according to claim 6, in addition to Claim 3 or the effect of 4, it has the following effects.

(1) If a pump is made to drive, fluid will flow into an introductory pipe or a stream pipe through a pump from a suction pipe.

(2) Since it is not necessary to have separately a pump for detailed air-bubbles generating, and a pump for stream generating and detailed air bubbles and a stream can be generated by one set of a pump, while excelling in productivity, excel in maintenance nature.

(3) Since neither air nor reactant gas is inhaled in IMPERA of a pump, or a casing, it can prevent that a pump starts a cavitation.

4) Since the reactant gas (for example, HCl, a fluorine compound, COCl2, etc.) of activity does not enter in the casing of a pump, the endurance of a pump can be raised.
5) Selection of a pump can choose only by the classification of a liquid and is excellent in flexibility.
6) When a detailed bubble generator and a suction pipe are thrown into the same liquid phase, while raising a gaseous dissolved rate remarkably, the liquid phase can be agitated and gaseous absorption efficiency and a gaseous reaction rate can be raised remarkably.
0043]

Translation done.]